

on them when they were very far from the sun, they then being simply white. I did not see any dark ones, as described by J. E. Clark; indeed they always struck me as being very thin, merely like a nearly flat sheet. They tended to be arranged in bands like "Noah's Arks," and, while their texture was smoother than most cirrus clouds, they were more or less striated transversely. On some afternoons I noticed in many cases a feeble smoke-like prolongation, or tail, on the east side of the cloud; this had no colouring. They had thus sometimes a striking resemblance to an aurora, differing essentially, however, in their real position being horizontal, while the auroral band and rays are almost vertical. Their direction also was quite different: on the 11th at 8'15 a.m., and 13th at 3'40 p.m. I noticed that the striae pointed to east by south. In shape they approached parallelograms apparently; really, to rectangles; sometimes they were very perfect rectangles. One of the most striking clouds was, however, a perfect right-angled triangle in form. Their motion was very slow. Some time after sunset they were so bright as to give a material amount of light, and to make the dust-circle around the sun look quite dim. They were evidently at a great height, though they looked lower than the dust-wisps. They were incapable of producing an ordinary halo.

Like Prof. C. Piazzi-Smyth, I can say that I have no recollection of seeing any clouds of the kind before. I saw nothing like them at the time of the grand sunsets last autumn, and I think he is mistaken in supposing any of the phenomena then seen were of the same character.

T. W. BACKHOUSE

Sunderland, December 22, 1884

REFERRING to the letters which have appeared in these columns on the subject of "Iridescent Clouds" as seen at Edinburgh and York on the evening of December 11, a very similar phenomenon was seen at Derby at sunrise on that day, and was thus described in the *Derby Express* the same evening:—"About half an hour before sunrise the eastern half of the sky was covered with a dense pallium of cirrus cloud. About 30° above the horizon was seen what appeared to be an elongated opening in the dark grey of the cloud. Through this spindle-shaped opening the sky was of an intense emerald colour. The strangest part of the phenomenon, however, occurred shortly before eight o'clock, when the vivid green had given place to a mass of brightness comprising all the prismatic colours arranged in bands transversely, each of the primary colours shading gradually into its neighbour in the same manner as in a solar rainbow. The appearance was now not unlike a huge many-coloured eye set in a dark uniformity of cirro-stratus. As the sun arose the colouring faded, and when the solar orb was several degrees above the horizon the phenomenon remained as a patch of brightness upon a silver-grey vapour, and was somewhat similar in appearance to an imperfectly formed parhelion. Its position, however, with regard to the true sun, showed at once that the phenomenon was not of the parhelion class."

C. J. P.

THE iridescent cloud effect mentioned by your correspondents (see NATURE, p. 148) was well seen here on the 13th about 4 p.m., and was very much as described by Mr. Clark. Three distinct bands of colour were seen just at the upper edge of a dark slate-coloured cloud towards south-west, and two faint ones on the clearer sky above. I write specially to remark on the nature of the colour of these bands. They were not prismatic colours as mentioned by Mr. Clark, but unmistakable interference or residual colours, the lowest bright purplish pink, shading into green, the next the peculiar light brick red seen in Newton's rings, and a very recognisable colour, also shading into green, and the rest pink and green, of similar colour to the lowest. There can be, I think, no question that this was an interference-phenomenon, and I hope some of your correspondents may be able to give the rationale of it.

Fairfield House, Darlington

JAMES L'ANSON

I SEE notes in NATURE, December 18, 1884 (p. 148), on iridescent clouds. I observed similar appearances on the Yorkshire Wolds, between Market Weighton and Brough, on December 6 and again on December 13, 3-4 p.m.; but instead of the clouds being totally coloured, only the edges of rifts in a thick cloud-mass were so tinged. The phenomenon was much finer on the latter date, the rift being much larger and the

colours more widely dispersed at one end, so that a rose tinge occupied there the whole of the acute angle of the gap.

Broseley, Shropshire

W. W. WATTS

The Rotation of Neptune

SEVERAL circumstances delayed my observation of the planet Neptune this autumn until November 24. On that and the two following nights the light of Neptune was compared with the light of the star B.A.C. 10272; and, assuming that the light of the star was steady, that of Neptune was found to undergo apparently regular variations, but much smaller than they were last year.

The observations were combined in the following manner:—The magnitude, m , at any time, t , was assumed equal to

$$m_0 + k \sin n(t - t_0),$$

where m_0 was the mean magnitude at the time t_0 , k one-half the variation between maximum and minimum, and n equal to 360° , or $45^\circ 45'$, according to the observations of Neptune last year, which gave $7'92$ h. as the rotation-period. Subtracting m' , the unknown magnitude of the comparison star, which is, however, of about the seventh magnitude, we have

$$m - m' = m_0 - m' + k \sin n(t - t_0);$$

and by assuming approximate values, by introducing corrections, and by solving the 11 equations corresponding to the 11 observations by the method of least squares, it was found that

$$\begin{aligned} m_0 - m' &= 0'86 \\ k &= 0'19 \\ t_0 &= \text{Nov. 24d. } 13'01\text{h. G.M.T.} \end{aligned}$$

The preceding epoch of maximum will be found by subtracting $1'98\text{h.}$; and similarly the following epoch of minimum will be found by adding $1'98\text{h.}$

Now these observations were made without special care, and consequently the probable errors were larger than they should be in comparison with the small variation; but on the night of November 29 every care was taken to obtain accuracy in the photometric measures, and the following results were obtained:—

$$\begin{aligned} m_0 - m' &= 0'82 \\ k &= 0'20 \\ t_0 &= \text{Nov. 29d. } 11'72\text{h. G.M.T.} \end{aligned}$$

The following is the comparison of observation and computation:—

Kempshot M.T. 1884 Nov. 29	Diff. mag. ($m - m'$)			o - C.
	h. m.	Obs.	Comp.	
7 10	...	0'91	0'92	-0'01
8 26	...	1'03	1'02	+0'01
10 5	...	0'88	0'88	0'00
12 7	...	0'64	0'63	+0'01

It should perhaps be added that Kempshot is $5'19\text{h.}$ west of Greenwich.

By comparing the epoch on November 29 with the corresponding epoch on November 24, we find that 15 rotation-periods occupy $118'71\text{h.}$, so that each rotation-period is $7'914\text{h.}$, which may be considered identical with the period found last year.

MAXWELL HALL
Jamaica, December 1, 1884

Peculiar Ice-Forms

CIRCUMSTANCES have prevented my replying earlier to Dr. Rae's letter in NATURE of November 27 (p. 81). The situation of the ice described in my letter of November 6 (p. 5) precludes the possibility of its having been a remainder from last winter's snow, since it was only some fifteen hundred feet above the valley of Chamounix, and exposed during the summer months to daily sunshine. In fact, the mid-day sun only just failed to reach it on the 17th of October.

In the *Neues Jahrbuch für Mineralogie* for 1877 (referred to by Dr. Wetterhan of Freiburg in NATURE, vol. xxi. p. 396) is an article by Dr. G. A. Koch giving an elaborate description and discussion of a very similar ice-structure, formed under very similar circumstances, which he observed on October 18, 1875, near St. Anton in the Arlberg. He also quotes other cases observed on the Wormserjoch in the Tyrol, and by Prof. Doenitz

in Japan. In all these, as well as in the case of the hills near Freiburg mentioned by Dr. Wetterhan, the soil appears to be a porous detritus with a hard substratum. At St. Anton, as at Chamoanix, the hill-side sloped at an angle of about 50° , with a northerly aspect, and in both cases and in Japan the phenomenon occurred in the autumn, a season often characterised, especially at high elevations, by cold nights and genial days. Dr. Koch calls it "*sunderbar*" and "*ganz eignethümlich*," and it is plainly not of common occurrence.

Dr. Koch's explanation of the phenomenon is virtually the same as had occurred to me, except that both he and Dr. Wetterhan appear to consider that the water was derived by absorption from a moist atmosphere. In none of the descriptions, however, is there any mention of what was one of the most striking features of the ice which I tried to describe, viz. its division into distinct layers, each layer being of uniform depth; and this, showing as it does that the crystallisation was interrupted, and not continuous, seems to make it more probable that the water was supplied from below. The cylindrical perforations were, no doubt, caused by the presence of pebbles or small lumps of earth too dense to allow the ice-crystals to penetrate them, and too heavy to be pushed up. The layer of dust on the surface was much thinner in my case than in Dr. Koch's, which was no doubt due to accidental difference in the soil.

A friend in the country tells me that on a bright winter's day two or three years ago he picked up a piece of a dead beech-branch which was covered with filamentous ice, such as is described by the Duke of Argyll and others in NATURE (vol. xxi, pp. 274, 302). He brought it home, and, having examined it, left it out in the sun, when the crystals of course soon vanished. Next morning, however, he was surprised to see that they had all reappeared as before. The water from the melting ice had again filled the pores of the wood, and again been extruded in the same crystalline form. Now, if the highest temperature to which they had been exposed during the day had been 32° F., and a fresh supply of water had been afforded from any source to the wood, then neither would the ice have melted nor the water frozen; until the temperature fell again at night, when a fresh formation of crystals would have taken place, which would have pushed up those previously existing, and the result would have been a formation similar to that described in my letter. It seems more probable, therefore, that the moistening took place from below, as I suggested.

Hampstead, December 20, 1884

B. WOODD SMITH

Lightning in the Tropics

MY experience confirms the remarks of Dr. Von Danckelman in NATURE (p. 127) respecting the little damage done by lightning in tropical climate.

In the plains of India at the commencement of the monsoon, storms occur in which the lightning runs like snakes all over the sky at the rate of three or four flashes in a second, and the thunder roars without a break for, frequently, one or two hours at a time. During twelve years' residence in India I heard of only two human beings and, I think, three buildings being struck, although in parts of Lower Bengal the population amounts to more than 600 to the square mile. I always attributed the scarcity of accidents to the great depth of the stratum of heated air next the ground keeping the clouds at such a height that most of the flashes pass from cloud to cloud, and very few reach the earth. This idea is supported by the fact that in the Himalayas, at 6000 feet or more above the sea, buildings and trees are frequently struck. I have seen more than a dozen pine-trees which had been injured by lightning on the top of one mountain between 8000 and 9000 feet high. In the British Islands thunderstorms are said to be more dangerous in winter than in summer, and such a fact, if true, can be explained by the very thin stratum of air then intervening between the clouds and earth.

J. J. MEYRICK

London, December 19, 1884

An Unnoticed Factor in Evolution

I AM surprised that the letter of Mr. Catchpool in NATURE (vol. xxxi, p. 4) has remained unnoticed by your correspondents. His hypothesis that mutual sterility may be the cause, not the result, of specific divergence, is, I think, quite in accordance with many observed facts. The buffalo and the ox, the sheep and the goat, have lived for ages side by side without, as far as I

am aware, a hybrid between either of them having been produced. Mule or hinny hybrids between the horse and the ass are obtained easily, but the offspring is rarely fertile, so rare, that the British Consul at Granada told me, when I was there, that he had never known of a case, although in Spain mules exist in thousands. Amongst bovine animals many species produce hybrids which are apparently perfectly fertile; those between the Indian ox and the gayal, species of different genera, *Bos* and *Bibos*, are common, and their fertility is shown by the existence of numerous intermediate hybrids. There is living at the Zoological Gardens at the present time, a hybrid between the Indian ox, the gayal, and the bison, and, by her side, a hybrid between herself and a bison. The offspring of the cross between many species of ducks are perfectly fertile. This I have repeatedly seen in the case of the hybrids between the tufted duck and the pochard. I think there is another *unnoticed factor in evolution*. The scent of animals plays an important part in their sexual relationships, and "sports" in this respect are as likely to occur as in the organs of the body; thus the peculiar odours of the sheep and the goat may be mutually repulsive.

J. JENNER WEIR

Chirbury, Beckenham, Kent, December 15, 1884

A Large Meteor

A MAGNIFICENT meteor was observed here last night. Its path lay from the west of σ Hydræ towards the west of η Monocerotis. Its head could not exactly be said to explode but broke up and extended suddenly considerably along its course, emitting a deep red and bluish white light, the latter of a most extraordinary brightness, for a moment quite sufficient to allow print to be discerned. It disappeared very near 11h. 19m. 6s. M.T. Dublin, and left a bluish white trace behind it, which could still with certainty be perceived seventeen minutes after the meteor had disappeared.

OTTO BOEDDICKER

Birr Castle Observatory, December 23, 1884

THE FORMATION OF THE SOLAR SYSTEM¹

THE aspect of the heavens, the appearance of the planets, do not give us the least idea of the solar system. In order to understand it well, we must in imagination quit our world altogether, and remove ourselves to a distance, so as to embrace in one glance the little system of which so ordinary a star as our sun occupies the centre.

Around the sun there move eight primary planets at very unequal distances. Of these planets six have satellites; that is to say, they in their turn are centres of little systems reproducing the solar system in miniature. Thus the Earth has a satellite, the moon; Mars has two, Jupiter four, Saturn eight, Uranus four, and Neptune, the most distant, has one. A striking thing in this system, that which makes it unique, is that the sun turns on its own axis from right to left, and all the planets without exception revolve around it in the same direction, almost in the same plane, that of the rotation of the sun, and describe orbits very nearly circular.

Would not one say that a vast gyratory movement animates all these bodies, and that the secondary systems of the Earth, Mars, Jupiter, &c., are little whirlpools moving in the primary one? Such was the idea of Descartes. If the solar system does not actually constitute a whirlpool, it was originally formed by a movement of this nature in the nebula which gave it birth.

The sky exhibits here and there a large number of gigantic masses of extremely rarefied matter, like the mists of chaos, without shape, having undergone only that degree of condensation necessary to create a feeble light. We require usually a powerful telescope to distinguish them, and then we can see them by thousands in the heavens; these are *nebulæ*.

When you visit an observatory under the escort of an astronomer whom you know, tell him several days beforehand that what you wish is not to gaze at the moon, or the planets and their satellites, or the fixed stars, double

¹ Translation of an article by M. Faye in a recent number of *L'Astronomie*.